

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
7 October 2004 (07.10.2004)

PCT

(10) International Publication Number
WO 2004/085353 A3

(51) International Patent Classification⁷: **C07C 5/09,**
B01J 23/44

(21) International Application Number:
PCT/EP2004/003263

(22) International Filing Date: 26 March 2004 (26.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2003/18888 26 March 2003 (26.03.2003) KR
2003/18890 26 March 2003 (26.03.2003) KR
2003/18891 26 March 2003 (26.03.2003) KR
2003/19039 27 March 2003 (27.03.2003) KR

(71) Applicant (for all designated States except US): **BASF AKTIENGESELLSCHAFT** [DE/DE]; 67056 Ludwigshafen (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MOON, Sang, Heup** [KR/KR]; Gyeongnam Apt. 3-801, Seocho-gu, Seoul 137-752 (KR). **KIM, Woo, Jae** [KR/KR]; Samsung Tower Palace E-4706 Dogok 2-dong, Gangnam-gu, Seoul 135-535 (KR). **KANG, Jung, Hwa** [KR/KR]; Cheongjin-dong 15, Jongno-gu, Seoul 110-130 (KR). **AHN, In, Young** [KR/KR]; Dong-a Heights Apt. 110-1708 Sindang 4-dong, Jung-gu, Seoul 100-761 (KR).

(74) Agent: **HÖRSCHLER, Wolfram, J.**; Isenbruck Bösl Hörschler Wichmann Huhn, Theodor-Heuss-Anlage 12, 68165 Mannheim (DE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,

MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:

— with international search report
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
23 December 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **PALLADIUM-BASED CATALYST FOR SELECTIVE HYDROGENATION OF ACETYLENE**

(57) Abstract: The present invention describes a Pd-catalyst, further consisting of La, Ti, Nb, K or Si, which have high ethylene selectivity even after a low temperature reduction in the selective hydrogenation of acetylene to ethylene and the production method of the same. A catalyst of the invention consists essentially of 0.05 to 2.0% by weight, based on the supported catalyst, of palladium and one or two metals chosen from the group consisting of lanthanum, niobium, titanium, potassium and silicon. The said catalyst is prepared by the following procedure: 1) Impregnating a support in aqueous solution of tetra amine palladium hydroxide, followed by drying and calcination; 2) The second and, if necessary, a third metal is impregnated by impregnating the Pd-catalyst in the solution of the metal precursor followed by drying and calcination; 3) The catalyst according to step (2) is then reduced in hydrogen at 200°C to 600°C for 1 to 5 hours.

WO 2004/085353 A3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003263

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07C5/09 B01J23/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07C B01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KANG J H ET AL: "Selective Hydrogenation of Acetylene on TiO ₂ -Added Pd Catalysts" JOURNAL OF CATALYSIS, ACADEMIC PRESS, DULUTH, MN, US, vol. 208, no. 2, 10 June 2002 (2002-06-10), pages 310-320, XP004465783 ISSN: 0021-9517 paragraphs 'ABSTRACT!', 'EXPERIMENTAL!'; figure 5 ----- -/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the International filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the International filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the International search

10 September 2004

Date of mailing of the International search report

12.1.10.04

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Holzwarth, A

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003263

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MOON, S. H. ET AL.: "Selective hydrogenation of acetylene on Pd/SiO ₂ catalysts promoted with Ti, Nb and Ce oxides" CATALYSIS TODAY, vol. 63, 2000, pages 183-188, XP002295683 paragraphs '02.1!', '02.4!', '03.1!'; figures 1,2; table 1	1-3,6,7, 10,11
X	US 6 413 905 B1 (KNOEZINGER HELMUT ET AL) 2 July 2002 (2002-07-02) column 2, line 63 - column 3, line 29 column 4, line 47 - column 5, line 50; examples	1-3,6,7
A	SHIN E W ET AL: "Performance of Si-modified Pd catalyst in acetylene hydrogenation: the origin of the ethylene selectivity improvement" APPLIED CATALYSIS A: GENERAL, ELSEVIER SCIENCE, AMSTERDAM, NL, vol. 223, no. 1-2, 10 January 2002 (2002-01-10), pages 161-172, XP004339426 ISSN: 0926-860X	
A	US 2002/165092 A1 (ZHANG HAN ET AL) 7 November 2002 (2002-11-07) paragraph '0047!; claim 1	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2004/003263

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: claim 1 (partly) - claim 3 (partly), claim 5, claim 6 (partly) - claim 7 (partly), claim 9, claim 10 (partly) - claim 11 (partly).

content of above mentioned claims, which relates to Pd-La and Pd-La-Si catalysts (embodiment 1 and 4)

2. claims: claim 1 (partly) - claim 3 (partly), claim 4, claim 6 (partly) - claim 7 (partly), claim 8, claim 10 (partly) - claim 11 (partly)

content of above mentioned claims, which relates to Pd-Ti-K catalysts (embodiment 2)

3. claims: claim 1 (partly) - claim 3 (partly), claim 6 (partly) - claim 7 (partly), claim 10 (partly) - claim 11 (partly)

content of above mentioned claims, which relates to Pd-Nb catalysts (embodiment 3)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/003263

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 6413905	B1	02-07-2002	DE	19854635 A1	31-05-2000
			EP	1004357 A2	31-05-2000
			JP	2000167401 A	20-06-2000
<hr/>					
US 2002165092	A1	07-11-2002	CN	1361231 A	31-07-2002
			CN	1364855 A	21-08-2002
<hr/>					